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solplan review

the independent newsletter of energy conservation, building science & construction practice

Inside . . . .

Energy efficient homes still require supplemental heat to maintain comfort conditions year round. Making a decision on the type of heating system to use is more difficult as manufacturers come up with new types of equipment. The fundamentals of heat transfer always apply equally to all systems. We discuss the fundamental elements of a heating system. It is the first of a series. Future issues will get into details of specific equipment.

We often hear about the high quality of construction in the olden days. Do we still build houses like we used to? Joe Lstiburek reviews how and why house construction has changed. New materials and new approaches improve the quality of homes. We even build them better - *if* we build them properly, but we must remember that a house is a whole system.

Home automation is going to get a much higher profile in the near future as the Smart House consortium in the USA begins its marketing program. We review what the Smart Home is and can do, and review the Smart House marketing program. We think there are some fundamental problems with the project at this time.

Other items include new product reviews, advanced concept housing program news, housing awards, TRC news, and more.

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Heating Systems

From the Publisher

The best feature of the R-2000 program has been the builder training program. In an industry that relies far too much on learning on the job, where mistakes are passed on from generation to generation, the R-2000 training workshops provided a new mechanism to offer training and upgrading for those already in the field.

I hear repeatedly how big the impact has been, and how many builders have taken the courses over the past few years. No doubt many have taken the courses. The increased knowledge has improved the standard of new construction in Canada by creating a larger pool of trained personnel. Industry surveys, such as the Pulse survey sponsored by Fiberglas Canada, indicate that the majority of CHBA members surveyed have taken the courses.

However, I wonder just how deep that penetration has been, and what are the lessons that have been learned. Has the training been taken to heart? Has it really had that much of an impact? What bothers me are the storied I am getting from various parts of the country about the difficulty prospective homeowners have in finding contractors and trades to apply the principles discussed in the courses.

If the lesson has been learned, builders should be encouraging the use of new energy efficient technologies and good mechanical systems, as these are being promoted not just for energy conservation but because it represents the good building practice. Instead, many prospective homeowners have to battle builders to get the kind of product they want. Why do trades and builders try to talk people out of building an R-2000 home? Why talk them out of mechanical systems that work well? They presumably should know that the R-2000 standard represents a higher quality product. If the builder didn't know about the new technologies, in the past he would resist changes. But if the lessons have been learned, why fight it?

There are too many half measures being taken. What is not being learned is that a house is a whole system that must be treated as such. You can't just take half measures and not encounter problems.

You think I'm overstating the case? Just look at the trauma that has happened with the recent changes in regulations requiring mechanical ventilation systems. If the lessons have been learned, the new regulations shouldn't be a problem. But that doesn't seem to be the situation.

Richard Kadulski,
Publisher

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Heating Systems for Energy Efficient Houses

by Richard Kadulski

The lazy days of summer may seem like an odd time to think about heating homes. Cooling may be more on your mind. But as surely as night follows day, so the long Canadian winter follows the brief hot summer.
The best energy efficient houses still require back space heating - it may not be much bit it must still be provided. But what is the best heating system to use in a low energy home? What is most efficient?

These are questions we often hear. Unfortunately manufacturer's claims further confuse consumers and builders alike. Unfortunately, as with so many other things, there is no simple answer. With this issue, we start a series on heating systems.

THIS IS A LITTLE CHECK... ARE YOU ALSO READING THIS?? XR. FAITHFUL CREW

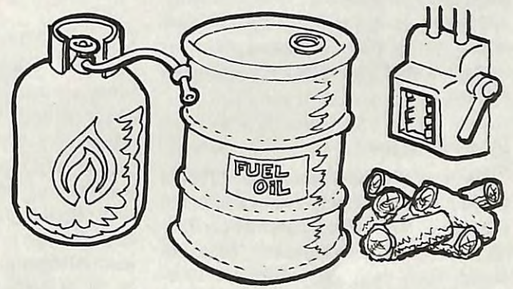
System Design

The heating system must be designed for the specific application. You must know the heat losses (and heat requirements) of the house in order to size the system properly. In the past, installers usually used rules of thumb to size the system. That was OK when most houses were uniform in size and construction practice (and energy hogs!) Today with the wide variety of construction materials and house sizes that is no longer good enough.

Fuel and System Type

When heat is called for, the source of heat is irrelevant. If 10,000 BTU's are called for, it doesn't matter how it's developed. 10,000 BTU's generated by gas, oil, electricity or wood is the same. The difference is only in the fuel: what it looks like, how easy it is to handle and how the heat is generated.

Heating equipment salesmen will try to tell you their system is more efficient than another one. Radiant heating systems salesmen especially have been known to talk about how their systems are more efficient than forced warm air or hydronic. It's not so! No system is more efficient than another. What does vary and hence makes one system different from another is the efficiency of conversion of the fuel into useful heat.



The fuel used to produce the heat should not be confused with the system used to distribute it. The choice of fuel is usually made on the basis of availability, price, convenience and cleanliness. The choice of system is based on comfort, cost, and controllability.

Forced warm air and hot water (hydronic) systems can be fuelled by any energy source.

There is, however, one type of system that is essentially synonymous to the fuel - the electric unitary system. It uses individually controlled room heaters, the most common being baseboards (low cost) and radiant ceiling panels (higher cost). Both can be designed, selected, and located to provide comfort, with substantially the same operating costs.

Heat Sources

There is a wide range of heat source options. The most commonly used fuels in Canada are natural gas and electricity. Oil heating still is important in some areas, but it's use is decreasing. Other fuel sources include wood, peat and coal.

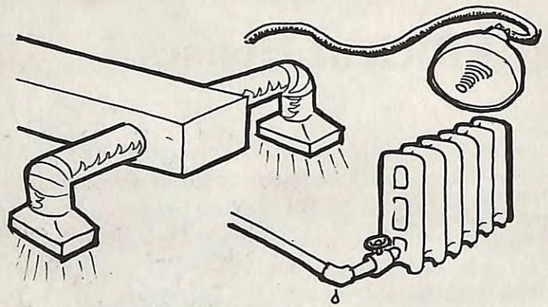
Properly oriented and designed houses will also gain much solar heat that is free and will reduce the amount of purchased energy.

A heating system can use several types of equipment. For example, in B.C. the Building Code requires that a heating system by capable of maintaining an indoor temperature of 22°C at outdoor design con-

Heating System Fundamentals.

1. There is no single heating system that is superior to any other; each has its advantages and disadvantages. Few that have stood the test of time have serious disadvantages.

2. Elements common to all heating systems are:
- *a heat source*
- *distribution system*
- *controls*



ditions. It is not required that the capability be all in one central heating appliance. For example, a home that has a design heat loss of 60,000 Btu/h could have a 48,000 Btu/h (output) furnace and a 15,000 Btu/h (output) gas fireplace in order to meet code requirements. Most gas fireplaces will operate in the event of a power failure. All other commonly used heating systems/appliances will not.

Distribution

To be useful, heat must be distributed where it will do what it's supposed to do. There are 3 ways that is done: by conduction, convection and radiation. There are several ways each system does it. Basically, heating systems can be categorized in two basic ways: forced warm air and all others.

Forced warm air systems

Forced warm air systems (FWA) are the most widely used heating systems in Canada. They are simple to understand, easy to operate, easy to maintain, and can easily incorporate ventilation requirements. Air filtration, humidification (not always required), circulation of "free" solar gains and summer cooling are all easy to incorporate with FWA systems.

The drawbacks to FWA systems are the intermittent nature of the system, fan noise and the fact that ductwork is usually installed by "rule-of-thumb".

Ducts have to be sized to suit the capability of the furnace fan, which is selected on the basis of furnace capacity (ie. Btu/h). However, as houses have become more energy efficient and furnaces smaller, the rules-of-thumb that worked so well in older installations are not appropriate today. Some installers may try to blame the furnace (or the fan) and will attempt to sell a larger furnace than is needed. Often, all that is needed is to redesign the ductwork and/or the installation of balancing dampers in the branch ducts to every room.

Non-forced air systems include all the other systems, which include baseboards, radiators and radiant systems.

Gas Furnace Types

Naturally aspirating are the standard furnace with "standing" pilot light and chimney or B-vent. Seasonal operating efficiency is in the 55-60% range, lower if the furnace is oversized. These will be disappearing from the market as new energy efficiency regulations in Ontario and B.C., as well as the USA call for a minimum efficiency rating of 78% (these would be the mid-efficiency furnace of boiler). When the regulations take effect, there will be few markets for the less efficient units, so they should be phased out of production. *(If you are making a decision in the next few months, why bother going to obsolete technology?)*

Mid-efficiency furnaces have an induced draft for the flue gas exhaust. Even though the combustion air comes from the space the furnace is in, a small fan is used to expel the products of combustion. Sealed combustion furnaces bring combustion air directly to the combustion chamber from outside. They may also have a draft inducing fan. Both have spark ignition (no standing pilot). One important benefit they have is that they can be vented horizontally through the wall, avoiding a chimney or B-vent . Seasonal efficiency for the mid efficiency furnace is in the 80% range.

Hi-efficiency or condensing furnaces take so much heat out of the exhaust gas that the water vapour in the gas is converted into liquid. Seasonal efficiency is in the 90% range.

Prices vary with efficiency. At today's fuel and equipment cost.The mid-efficiency furnace is the most cost-effective in the mild areas,

Hydronic systems

Hydronic (hot water) systems have experienced a remarkable increase in popularity in the last 5-10 years, particularly for radiant floor systems. Usually costing close to twice as much as a FWA system, a well-designed hydronic system can provide great comfort. However, a poorly designed and/or installed one will be an expensive disaster. Successful hydronic systems must be:

- designed by a competent technician or professional;

- installation must adhere to the design; any deviations or variations should be approved by the designer.

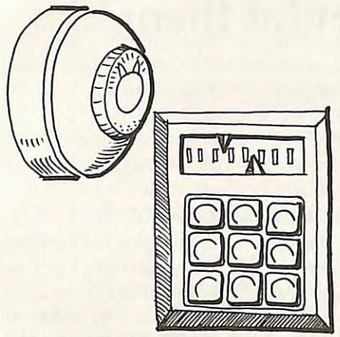
- radiant floors must be insulated underneath and around the perimeter (including concrete slabs on grade). This is particularly important where the slab is on wet soil or on rock.

Perhaps the closest non-electric appliance to the electric unitary heater is the gas fireplace. There are two types - space heaters and decorative appliances. The space heater types are true heating appliances, having an efficiency of about 75% and can be used as an integral part of a home heating system, rather that just as a supplement. The decorative types (frequently called "firelog sets") are as efficient as the fireplace they are installed in. In a conventional masonry fireplace, efficiency may be 10% or less.

Controls

Each heating system must be controlled in some fashion; most rely on a thermostat.

Thermostats are temperature operated switches that open or close an electrical circuit in response to temperature change, thus turning the heating system on or off. A good thermostat is essential to obtain the



maximum in comfort, convenience and economy of any heating system, while a poor thermostat will reduce the performance of even the best heating system.

Setting the thermostat back just a few degrees at night when a lower indoor temperature is comfortable can save fuel, especially in an average conventionally built home. As the house becomes more draft-free and energy efficient, the less the impact of the setbacks as the house does not loose much heat, so by the time the temperature decrease, the next cycle has already begun.

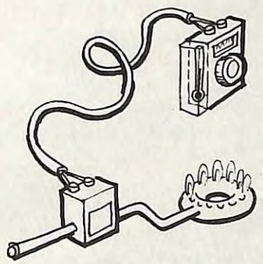
Thermostat location is important as they should be mounted approximately 1.5 m (5 ft) above the floor, centrally located on an inside wall. They should never be installed in areas subject to drafts, direct sunlight or near sources of heat, such as warm air registers, refrigerator, ranges and other heat generating appliances (this includes TV's and VCR's) .

For electric systems, low voltage (24V) thermostats offer better control than line voltage (240V) units but at a higher cost. Line voltage thermostats are low cost units used exclusively with in room electric heating systems. Their slow response can result in large temperature swings above and below the thermostat's temperature setting because the full heating load passes through the thermostat so the thermostat itself heats up when the heater is on. This means the thermostat responds to its own internal heat and will shut off prematurely. Due to their low cost, line voltage thermostats are often used in low-budget or economy-type housing.

Low Voltage are the standard thermostats used for gas, oil and electric central heating systems, and electric unitary heating systems where better control is required. They operate on a 24V power source provided by a transformer fed from the standard 110V electric service in the home.

There are two categories of low voltage and electronic thermostats. Programmable thermostats have the ability to control two or more different temperature settings with two or more time-of-day or day-of-week settings. These range from simple clock-type thermostats that provide a day-night temperature setting, to the electronic models which allow for several different settings.

Electronic thermostats replace the mechanical temperature sensing and switching devices of a low voltage thermostat with electronic or solid state components. They provide very accurate temperature control and operate either conventional or electronic relays. They are also the basic component or many of the new programmable thermostats.



Zone Control

Zone Control is the ability to maintain either different conditions within a building, or similar conditions within a building in spite of highly variable outside conditions. Basic zone control can be as simple as dividing the house in two: north and south (i.e. shady and sunny), or upstairs and downstairs (i.e. sleeping area and living area). In a modest sized energy efficient home zoning of areas is not too critical as there is very little temperature stratification, and zoning will not have a major impact.

As heat always flows from hot to cold, it is not possible to have a very large temperature difference between zones (or the hotter zone will start to heat the cooler zone). But zoning does provide a way of improving comfort, as a small temperature difference between some areas may be all that is needed.

More often, however, a house will be divided into three, four or more zones on the basis of exposure and room function. For example, north bedrooms and south bedrooms may be zoned separately, with all bathrooms in a third zone; living and dining rooms a fourth zone; kitchen, family room, etc. a fifth zone. The ultimate would be to make every room a separate zone, although this would add an increment of cost to the home. Thoughtful design and careful consideration of room uses and exposures should make it possible to

Zone control is typically used with hydronic (hot water) and electric unitary (in room) heating systems. Zone control devices are available for residential FWA systems but are not widely used at this time. However, they certainly have a market potential, particularly in larger homes where the typical FWA zoning arrangement has been to use two furnaces. A standard residential forced warm air system does not have zone control other than what can be provided by manual adjustment of the dampers in the air-outlet registers.

Hydronic systems offer a good opportunity for zone control and taking advantage of this opportunity is recommended.

Electric central heating (either FWA or hydronic) is zoned the same as a fuel fired central system. The fact that electricity is used as the fuel has no bearing on the zoning of a central heating system. Unitary heaters, such as baseboards, radiant ceiling panels or wall heaters are controlled by a thermostat in the same room so each room is a zone. The quality of the thermostat usually determines the degree of comfort and satisfaction with the zoning.

In coming issues we will go into greater depth into specific system types and review different equipment available in the market.

Wood Frame Construction: Do we build them like we used to?

by Joe Lstiburek

We still hear the question, "Why can't we build houses the way we used to? We never had problems before." The answer is simple: people's expectations and the price of materials, labour and energy won't let us. Expensive construction costs, high energy bills and draughty houses just aren't acceptable to today's home buyers.

The problem is that we can't seem to build a new house today that will last. In Ontario, where detailed warranty statistics are kept, 2 out of every 10 basements get dug up within the first five years and get repaired. Mould and mildew in new U.S. homes has become so commonplace that it is beginning to be accepted as the norm. Roof shingles are often replaced within 10 years. Paint seems to fall off siding every year. Has anyone ever seen a new home without drywall or cracks? Interior moisture problems happen in all climatic zones. Once people move into these new homes they begin to get sick and, recently, with alarming frequency, they actually die from malfunctioning combustion space and water heaters.

But decaying homes and dead clients are not good for business!

When we renovate, rehabilitate, or upgrade we often work on buildings that have been around for 20, 30, 50, 75 years or more without substantial problems. Yet when we "fix" them, or "improve" them, by adding insulation, installing new windows, replace furnaces, change siding or finish basements we introduce them to the same problems found in today's new homes. It's as if they suddenly begin to behave like new homes. They now age at an accelerated rate and begin to deteriorate right before our eyes.

What's going on? We can't seem to build a new home that lasts, and we can't seem to fix an old one and have it continue to last. What has changed? What are we doing that is so different that is causing our new and rehabed housing stock to deteriorate?

We need to go back and understand what made our older housing stock so durable. How were these buildings built and why did we change the way we built them? What were the impact of these changes

on durability?

Homes at the turn of the century in North America were not particularly very comfortable. They were cold and draughty. Temperature stratification in rooms was common. It was not unusual to have a 10 or 20 degree Celsius temperature difference between floors and ceilings. It was possible to wake up on a winter morning in Saskatoon or Winnipeg and have your sheets frozen to the wall.

Insulation for Comfort

The first major change to construction practice was the introduction of thermal insulation to wall cavities and attic ceilings in the 1930's. Insulation was added for comfort. People got tried of scrapping ice indoors. Adding thermal insulation to the building envelope had two dramatic effects on the performance of the typical wood frame home. First, and of most importance to the builder, occupant comfort increased as heat loss through the building envelope was decreased and there was a more uniform heat distribution within the building. Second, as the insulation did its job keeping heat inside the building it reduced heat flow and air circulation through the cavities in the building envelopes. The sheathing, building paper and cladding now began to operate at a colder temperature. When these components became "wet" (usually as a result of exterior moisture, rain and dew) they stayed wet longer. The addition of insulation to the building cavities served to reduce the "drying potential" of the building envelope by reducing air circulation and heat flow. The more insulation and the more effective the insulation, the lower the envelope drying potential.

New Construction Trends since the 1930's

We've been adding insulation to building envelopes since the 1930's, and presumably been reducing wall and building drying potential since then. So why didn't we see building disasters in the 1940's and 1950's? Why didn't Canadian and American cities come crashing down before our eyes as a result of rot and decay. Obviously other factors were at play.

One of these was the "leakiness" of older buildings. These older buildings were full of holes and they had a high airchange rate. A high airchange in a leaky house (in a heating climate) meant that interior moisture levels were kept extremely low as the cold replacement air contains very little moisture The airchange process serves to "flush" interior moisture out of a building enclosure. The leakier the building, the higher the airchange.

However, the typical North American wood frame home started getting "tighter". A standard new home built today is four times tighter than the standard new home building fifty years ago it wasn't entirely due to energy driven programs of the late 1970's that encouraged air sealing. Like most things in the building industry, the tightness happened as a byproduct of other more important factors, such as cost and ease of construction.

In the 1940's "platform" framing became more common than "balloon" frame as it was a faster, less expensive way to frame a house. Gypsum wall board (drywall) began to replace plaster and lath as an interior surface finish during this period as it was faster, less labour intensive, therefore less expensive to use. It does not take much insight to realize that a platform framed house with gypsum wall board as an interior surface finish is much "tighter" than a balloon framed house with plaster and lath. The move to platform frame construction with gypsum wall board took almost twenty years. (No one ever said change in the industry occurs quickly.) The result was a less expensive house that happened also to be tighter.

In the 1950's and early 1960's sheet goods such as plywood and asphalt impregnated fibreboard began to replace wood boards and plank decking on subfloors, and as roof sheathing and wall sheathing. These sheet goods were faster and less expensive to install and soon dominated the market. The building envelope also became dramatically tighter.

The trend towards sheet goods was not due to a desire for a tighter building envelope, but because it was faster and less costly.

Energy conservation and draftproofing

The energy crisis of the mid 1970's became the first overt encouragement to build tighter building enclosures.

As the building envelope became tighter, the airchange rate decreased. The interior moisture levels increased as the flushing action of high airchange rates was reduced.

Another factor also began to influence envelope durability. During the late 1960's and early 1970's new cladding systems, such as hardboard aluminium and vinyl siding were introduced. These systems, while not being more airtight than the traditional wood cladding, were far less vapour permeable, so drying of the building enclosure to the exterior by diffusion was reduced.

The trend towards greater airtightness date back to the 1940's and the lower permeability claddings date back to the 1960's. Yet it is only in the early 1980's that we began to see "building disasters" relating to moisture and durability. Why is it? The major reason is how homes are heated.

New Heating Systems

Until very recently, we used some form of combustion appliance coupled to an "active" chimney to heat our enclosures. We burned wood, coal, oil, and natural gas in furnaces that required air for combustion and generated combustion products. Additional air coupled to the active chimney was needed to exhaust these products of combustion from the house. Such great quantities of air were required that as far as the house was concerned, these chimneys were nothing more than "chimney fans" or exhaust only ventilation systems.

The operation of "active" chimneys increased the building airchange rate and therefore reduced interior moisture levels. The exhaustion depressurized the building to the point that infiltration happened over the majority of the outside envelope. It really did not matter very much how the building envelope was constructed as long as infiltration was occurring.

In the early 1970's there was a trend away from negative pressure houses with the introduction of electric heating. The moment "active" chimneys were removed, airchange rates were reduced, and background moisture levels increased. More importantly, the neutral pressure planes began to lower. The typical building envelope went from a slight negative pressure to behaving like a hot air balloon that was too heavy to leave the ground. Cold, dry air would infiltrate the lower portions of the building, pick up heat and moisture, and exfiltrate through the upper portions of the building. The exfiltrating air, was leaving at higher levels of moisture through fewer locations and these places were connected to building envelope cavities which were at a lower drying potential.

Electric heating is not the only culprit. New energy efficient combustion appliances also consume less air. As far as the building envelope is concerned, these new efficient combustion appliances resemble electric heating.

Today's houses, newly built or renovated, with high levels of insulation and low drying potentials, low airchange rates and low neutral pressure planes are major candidates to long term durability problems.

Unfortunately, durability of the building enclosure is not the only concern. As the building enclosures become tighter, combustion appliances and their "aerodynamically coupled" (to the enclosure) chimneys begin to compete with other air consuming devices in the buildings for air. The "passive" chimneys don't always "win" the competition for available air

and spillage and backdrafting of products of combustion happens. The impact on health and safety is obvious.

As building enclosures become tighter and airchange is reduced, not only do background moisture levels rise, but indoor pollutant levels also rise. It has become clear that the trend towards "tight" construction cannot continue without some concession to "controlled ventilation".

The House is a system

It is sad and ironic that in North America we are actually "*institutionalizing*" the process of problem creation. Government programs promote higher levels of insulation and more recently tighter building enclosures in order to save energy, without appreciating the impacts on durability of the structure and the health and safety of the occupants. Energy conservation important, but health and safety of the occupants and the durability of the enclosure is more important.

This is why recent code changes were made to mandate mechanical ventilation.

It is inevitable that todays homes will continue to have high levels of insulation, low airchange rates and lower neutral pressure planes. It is critical that building envelope design and construction reflect this new reality and compensate for it. It is possible and desirable to build building enclosures with levels of insulation and also high drying potentials. It is possible and desirable to build "tight" building enclosures with combustion appliances which do not interact with the occupants and other air consuming devices. It is possible and desirable to maintain the air quality (health and safety of the occupants) in a controlled manner within these "tight" building enclosures.

It emphasizes the importance of keeping in mind that a house acts as a whole system: you can't make changes in one area without considering the impact on the whole.

Letters to the Editor

Sir,

A copy of your April-May issue of Solplan Review recently crossed my desk, and I am perplexed as to what you as the editor-publisher view as editorial and advertising content.

In particular, I refer to the copy on page 8 under the heading "Coloured Window Spacers" that is blatantly an advertisement in the guise of a poor editorial.

The source of this information is Mr. Michael Glover, employed by Edgetech. Those of us in the glass business would know who wrote this article, although I would suspect most of your readers would not.

Tremco Ltd., a company who has served Canadian industry and consumers since 1929, finds that our name and product being mentioned specifically is in very poor taste and reflects on both Mr. Glover's way of doing business and your editorial policies.

For your information, let me give you two important facts:

1. In Canada last year, there were over 3.2 million windows produced with Tremco's "Black Swiggle Strip".

2. Our product has produced insulation glass units that meet a Canadian Standard for insulating Glass CAN 2-12.8M since 1979 and over 125 Canadian Companies currently use this product.

I encourage you to ask Mr. Glover how his product compares against these real facts. I would also add that the sales and promotion techniques employed by Mr. Glover and his company are not sanctioned by the Insulating Glass Manufacturers Association of Canada.(IGMAC)

In summary, we vehemently oppose such slanted information presented in an unprofessional manner making reference to our company.

Stephen E. Dodd
National Sales Manager
Tremco Sealants Division
Toronto, ON.

Products we may highlight are chosen based on what we find of interest, and that we think will be of interest to our readers. While we accept paid advertising, we do not do advertorials.

Product commentaries are written by us, and commentary on the product's value or lack there of are independently arrived at. The item in question was written by myself, not Mr Glover (although it was based on product description issued by Edgetech)

I am informed by Edgetech that their Super-Spacer in combination with appropriate sealants meets the CGSB 12.8 standard for insulating glass. I am also advised that Mr. Glover is a member of the IGMAC Technical Services Committee, and Edgetech is an active supporter of IGMAC activities. A number of their Super Spacer customers are in the process of being certified by IGMAC.

Personally I have no problem with a black spacer. Objections to black window spacers are a comment I have heard from builders and window suppliers in B.C.. The superior thermal performance of insulating spacers is known and I recommend them. In Solplan Review No. 20 (April - May 1988) we reviewed a study that compared common spacers used and identified the improved performance that Swiggle Strip provided.

I am pleased to hear that the Swiggle strip has a good market penetration. In the many houses I have inspected throughout Western Canada the conventional metal spacer seems to dominate the market. Insulating spacers of any kind seem to be the exception. Ed.

Sir,

I enjoy reading Solplan Review and applaud the way it presents the latest technical information in a simple and clear manner.

Canada Post: "we don't deliver parcels anymore"

Last issue I thought we had put behind us the sad tale of how Canada Post's service had deteriorated. Aside from outrageous rate increases, the service has been restructured and services cut.

It seems that "Service" has long since been taken out of the objectives of the corporation as the Federal government has abdicated all responsibility. (Has anybody gotten an acknowledgement from Harvie Andre, the Minister "responsible" for Canada Post? All mail seems to come from anonymous Canada Post managers).

As no one seems to be in control, Canada Post must figure they can do whatever they want, never mind about the public. The latest "service improvement" we have discovered is that Canada Post no longer delivers parcels.

We only discovered this by accident, when we had to pick up a parcel they "couldn't deliver" as there was no one at the address, which was a blatant lie as the parcel was addressed to our office, where during extended business hours there are many people to accept deliveries.

Following up the card, I was told point blank that they would not deliver the parcel, and in fact for the past 18 months they had stopped delivering parcels over 3 pounds in weight (unless shipped by Priority Post).

For the record, the parcel weighed 2.6 pounds (on their official scale).

Is this the end of the story?. I sure hope so, but based on the recent past history, I'm not holding my breath.

Richard Kadulski

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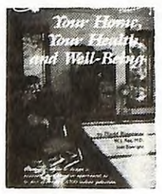

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The big problem with insulating foundation walls from the exterior has always been one of how to protect the insulation from damage by ultraviolet radiation or mechanical abuse

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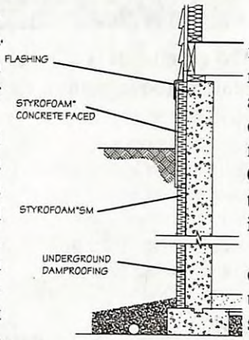

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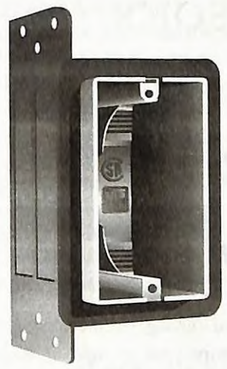

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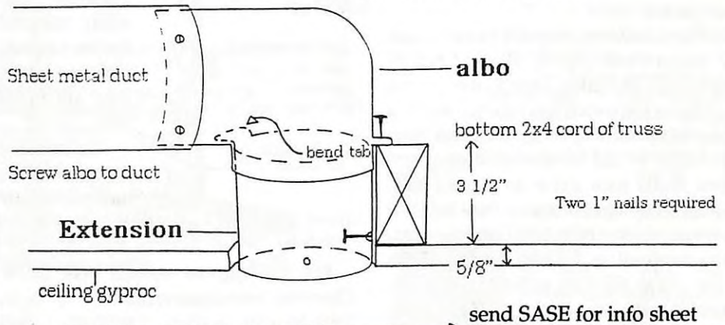

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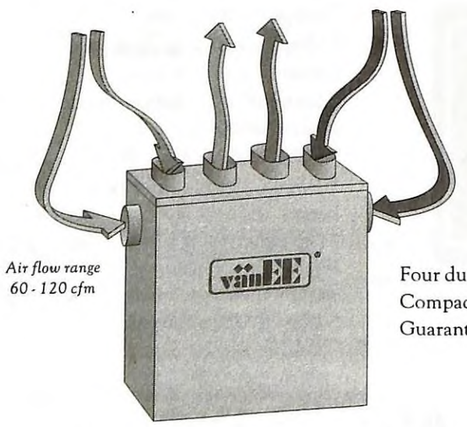

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Referring to the article on Advanced Concept Houses in your April-May 1991 issue, I would like to thank the author of complimenting the research of the Division of Building Research at the National Research Council which, as he correctly implied, has contributed to Canada's leadership in housing technology. However, I would like to correct the author's facts in that this division of NRC was not shut down. The Division of Building Research has just changed its name to the Institute for Research in Construction (IRC) as of 1985, to reflect the breadth of research activities related to all aspects of construction. IRC is still very active in performing leading edge research that continues to maintain Canada's leadership in many areas including housing. IRC (as DBR was) continues to contribute to CHBA activities and is still represented on the TRC.

In addition, IRC is expected to play a significant technical role in collaboration with EMR and others towards achieving the goals of the Advanced Houses program.

Sherif A. Barakat
Head, Building Performance Section
Institute for Research in Construction,
NRC

Our apologies for prematurely closing down the IRC. The reorganization and the subsequent lower profile of the division's information program has left the impression that if not shut down, it has greatly reduced its level of activity. DBR used to be a tremendous source of technical information with an information outreach program that included publication of reports and publications such as the Building Digests, Building Performance Notes, etc. that outlined the latest research findings at NRC, but we haven't heard too much about it's research findings recently. Ed

Sir,

How about a contest design for a 'zero energy' house, with minimum cost over its life cycle (say 50 years)? Cost can be defined as the capital cost plus interest plus energy consumption. Set the interest at 10% and energy cost increases at 10% a year. The first prize to be an all expense paid trip to Kuwait, second prize an all expense paid trip to Calgary, third prize a one year subscription to 'Oil Week'.

Financing is becoming very difficult for almost anyone of modest means. I suggest that as a long term solution utilities like B.C. Hydro could get into finance. If they were to finance the extra cost of an R-2000 or zero energy house (up to $ 10 - 20,000.) the owner could pay it off on his monthly utility bill over say 20-30 years at very low interest - say inflation plus 1% for administration. Homeowners would thus get the benefit of the preferential financing rates that large utilities enjoy.

This would give the utility a certain, significant reduction of energy consumption. The total energy savings of the house over a 30 - 40 year period would pay for a major part of the total cost!

This scheme would give low income people a boost and also give the housing industry a shot in the arm. I t would also make B.C. a world leader in energy efficient technology which could be exported. This program could also be extended to industry and make all of our industrial sector far more competitive.

It seems to me that Hydro if it were farsighted and innovative, they could raise funds for this type of program by using the monthly Hydro bill as a monthly 'financial statement'. Customers could sign up to be 'Energy Investors' by paying $ 5 to 50.00 or more each month extra on the bill. The extra would go into a 'Zero Energy' fund that would get a dividend or interest on the investment each year. They can take it out at anytime. The interest rate would have to

Clean Gypsum Board

The best way to ensure indoor air quality is to avoid the use of harmful and/or objectionable materials (i.e. make sure the pollutants don't enter the environment in the first place).

The off-gassing characteristics of a coating on an interior surface such as wall or ceiling (paint or paper), is at least as important as that of the substructure. There has been much discussion recently about how ''clean'' drywall is, as there have been reports that drywall is not acceptable for very chemically sensitive people.

The ingredients in gypsum board are paper and gypsum, with no significant additives added. Industry sources have not been able to pinpoint the source or evidence of problems - formaldehyde being the major offending compound. However, it appears that some years ago there was a U.S. made product that used urea formaldehyde (UFFI) mixed with the gypsum to make a lighter weight product. It was not long on the market, but how much was produced is not known.

One possible source of offensive compounds that hyper sensitive persons may detect could be gasses and compounds that are absorbed by the board - e.g. cigarette smoke and other compounds in the factory and wholesaler's warehouse.

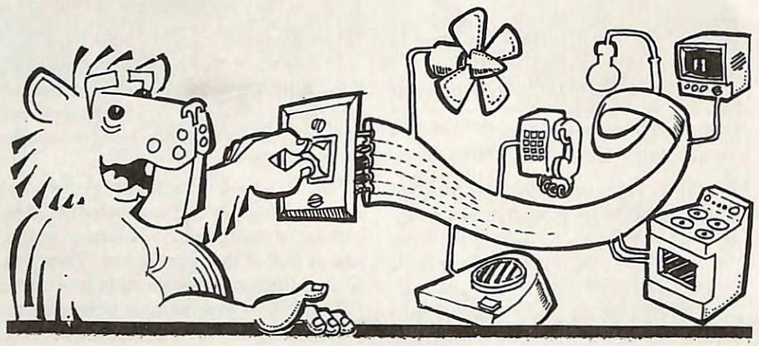
A more detailed study may be justified to determine what the ingredient(s) are

that some people find objectionable, and to determine if the off-gassing decreases with time. It could also be that the joint material could be a problem. Paints and other wall coverings may the the greate problem source.

Technical Excellence Award

As we were going to press your Editor was surprised to receive the news that the **Greater Vancouver Home Builders Association** presented their **1991 Technical Excellence Award** to him. The citation reads: *''presented to Richard Kadulski for his dedication and leadership shown in the promotion of technical excellence to the community and industry at large''.*

Thanks guys. It came as a total surprise! RK



Home Automation

Richard Kadulski

It can be the ultimate toy. It can also change the way we build and use houses.

Just think about the last time you had your hands full, trying to find the light switch whenthe doorbell rang. Chaos? Frustration?

It would be no problem if you lived in a Smart House. Motion sensors could turn the lights on when you enter a room, and a video monitor would show who was at the door.

Complex? Far fetched? Overkill? Expensive toys for the idle rich? If you think about it, the automated house is just the natural evolution of house technology. And the ability to control the functions in the house. When we moved out of the cave into build homes, when we went from the open fire to the stove, we started to control our home environment.

When heating systems were installed, we started using thermostats to automatically control the heat. In greenhouses and solariums we use automatic window openers to open windows to vent the space and prevent over heating. Stoves and ovens have timers and clocks so that they can be turned on a preset time. Even VCR's can be programmed to pre-record favourite programs when we can't watch them.

What's new in home automation?

We will be able to control all household appliances from a single point using a single controller. The principle is simple: A prewired system is connected to a main central computer that can be programmed to provide room-by-room temperature and security control and to control a homes's lighting and appliances. It can be operated in a variety of ways and use motion detectors, pressure sensors and timers to allow a hands-free approach to controlling the home environment.

The heart of the system is special wiring that uses a single cable that can include the television cable, copper-sheathed electrical wiring and the security wiring. The appliances are independent, so that residents can add and upgrade such options as a touch screen - controlled or voice controlled home automation system, an interior security system, or a whole house Audio/Video system when they are ready.

Who will benefit from Home automation?

Automated homes will be of particular interest to those with limited physical capabilities, such as paraplegics or the elderly. While this group will be the real beneficiaries it will be many years before many will see the benefits as the marketing is being targeted to the upscale market.

The key markets being chased by the Smart House consortium are the wealthy in major metropolitan areas, trend setting suburbanites and upper middle class families (the Yuppies and Techies) with average family incomes over $100.000.00 U.S..

Systems are still evolving. What we will see in 5 years will be much different home what we see today. But the basics are already here.

What complicates the situation is that there is no agreed on standard for the electronic controls. There are 2 main draft standards on the market now: the Smart House and CEBus.

Smart House

Smart House was developed by a limited partnership between the National Association o f Home Builders (in the USA) and manufacturers who wish to produce Smart House compatible appliances.

The key elements of an automated house are:

- specialized wiring
- controller
- appliances capable of communicating

Members will receive dividends from the sale of Smart House products, such as chips and some assembled products, and the licensing fees the project will receive from other manufacturers making Smart House compatible products.

CEBus

CEBus is the Electronic Industry Association's home automation standard. Although both are potential home automation standards, they are not exactly direct competitors. CEBus will be an open standard, with the technology developed made available to any interested manufacturer. It is based more on existing wiring and allow a much broader retrofit market.

The Smart House is a closed standard, meaning all products using the technology would be licensed and pay fees to Smart House. It is a proprietary system launched by the NAHB in 1984 as a limited partnership. Although a retrofit product is planned, Smart House is aimed at the new construction market; a retrofit product will not even be available until 1995.

Is one going to emerge a clear cut winner? It's hard to say. However, it's a bit like the VCR. The Beta format was developed and owned by Sony while the VHS was an open system open to all manufacturers. In the computer world, the IBM - PC was accessed by others, while apple tightly controlled their computer architecture. We know which systems are dominant in their field.

A similar scenario could happen to Smart House.

The wiring

All automated home systems require specialized wiring that not only provides power but also enables a communications signal to be carried - i.e. the message to turn on or off an appliance. The Smart House wiring is a special bundle of cables that contains electrical cables, 6 low voltage wires for control communications, telephone wire and co-axial cables (to carry video signals).

The wiring goes to all electrical boxes as a bundle, and you plug in the types of services you want to get out of the outlet.

The controller - a central computer, is programmed to provide those functions that are required. It can activate outlets and appliances as desired.

Smart Appliances

Appliances capable of using home automation are a key to making the whole work. Without the right appliances, all you have is a dumb house with fancy wiring and plugs.

At the moment, the best that can be done is to turn on or off a given appliance (much the same way as a timer clock turns a lamp on and off at the present time). Smart appliances will have the capacity to respond to all their programming capabilities from a central or remote control device - one will do all. Your TV remote control is different from the VCR's remote and they don't operate the radio, stove or radio. Smart appliances will.

With the right appliances you will be able to start the coffee, turn up the heat in the kitchen and lower it in the bedroom. It can turn on or tape your favourite TV show and automatically place a wake-up call to the kids. While you sip your morning coffee it could cut off power to the curling iron which has a defective cord.

It could monitor your baby, letting you know that baby's awake. Then it turns on the light in baby's room and begins heating the bath.

Smart House won't change a diaper but can alert you to a broken basement window and dial the police. It can stop a gas leak and tell you about it.

The biggest difference for home buyers is wiring. Other features can cut energy consumption by controlling heating and cooling systems to get the optimum output from the system. Just tell the computer what you want. Window shades can be programmed to close when the afternoon sun shines through bedroom windows in the summer, reducing excess heat.

The problem is that these appliances still aren't available. Smart House itself is still working to develop its central controller.

Smart House Promotion starts

Smart House, in an attempt to jump start the market - plan to have 150 houses (1 in each major metropolitan market in the U.S. and Canada) built over the next 21 months.

Each house will receive plenty of promotion and exposure - the theory is that consumers will breathlessly stand in line to buy these houses.

If they are successful in getting the houses built it will be a triumph of guts and hype over economic reality. Great for them if they succeed - but are there that many suckers out there? Local home builders associations are to coordinate each demo house and training.

But the builder is expected to pay the full cost of the wiring and components. Smart House itself will not offer anything other than technical advice (and remember: its a proprietary corporate profit making venture) so the effort that is put into these demo houses supports their corporate goals above all else.

When was the last time a supplier made you pay a premium for their new, untried product or equipment as it was launch? In other words, you pay for their marketing and development costs.

Usually, part of the cost of marketing is to offer the goods or services at a deep discount in order to generate the exposure.

The roll out market strategy is one issue. But there are several other more fundamental flaws with the Smart House approach at this time.

Concerns about the Smart House Roll-out

1. Cost

Upgrading products and introducing totally new products will be more expensive.

The current incremental cost for a Smart-Redi House - (i.e. all the core wiring, fittings, etc.) will add around US$ 8,700 to the cost of an average sized home (plus local taxes, plus GST). In addition, the controller unit (to be ready later this year) will add another US$ 1,500 - 2,000.

To the Canadian Builder this means an extra CAN $ 13,000.00 or so (plus local taxes). This is around 10% of the construction cost - and don't forget that to take advantage of the system new appliances (not yet on the market) are required. How many people do you know are willing to spend that kind of money?

SMART HOUSE is forecasting 5000 houses in the first year, rising to 440,000 houses per year (in the U.S.) by 1999. The forecasts seen outrageously optimistic unless prices decline.

Yet the best estimates available are that there will only be a 25% reduction in price onceall manufacturers are geared up and mass producing equipment.

2. Non airtight outlet boxes

The house works as a system, and to ensure structural durability it is important to ensure that building envelopes be built either very loose and drafty or airtight. As our winters are long and cold, and we have become creatures of comfort, insisting on keeping our homes comfortable and draft free, we insulate and seal our homes. But it must be done right.

Electrical boxes are a significant source of air leakage, and we have seen the development of many airtight products.

Where does the Smart House outlet box fit? It is much bigger than the conventional outlet box and has a whole that is several inches square. It's not airtight, not meant to be and they do not appear to be concerned about the need to seal penetrations. (Remember: outlets are located at regular intervals, so there is quite a few of them in a house).

3. Codes and Standard approvals

In the U.S. the Smart House group is working with UL and various regulatory bodies to gain approvals (not all are in place yet). But they don't seem to have any idea of the Canadian approvals process. So far, there have only been preliminary discussions with CSA for certification in Canada. This should not pose to big a problem as there is an agreement between CSA and UL to develop reciprocal recognition of approvals (i.e. once one approves a product, the other will accept it).

But CSA approval only applies to the electrical equipment. There has been no communication with electrical codes authorities, nor with phone companies (for approval of interconnect) or cable companies who charge by the outlet (and which are regulated by the CRTC). If you can make any outlet a cable TV outlet, it doesn't fit in with the way they do business.

The CHBA Connection

The Smart House project was initiated by the NAHB in the U.S., but is a subsidiary for profit corporate partnership between NAHB and a limited consortium of companies (3 manufacturers of each core product).

Now that a product has been developed and is being rolled out, they are beginning an aggressive market campaign.

CHBA was invited to sit on an advisory council with participating manufacturers. CHBA accepted to ensure that Canadian builders have access to Smart House technology as it is being commercialized. Otherwise, there is no commitment or endorsement implied (even though their pitch implies there is).

Where do we go from here? It may seem I am down on the concept of home automation. The concept is sound and to be encouraged. However I believe there is too much hype surrounding the Smart House roll out at this time.

If we as an industry are concerned about providing housing for all, and affordability is such a big issue, is this the time to add 10% to the construction cost of a new house for something that won't deliver the goods for some time yet?

How responsible is it to be pushing such a costly technology that makes everything on the market totaly obsolete? I think it may be premature for a mass roll out as its is being done at this time. It's just too rich.

Smart House is not the only player in home automation. The CEBus manufacturers are developing more open systems that are flexible and more economical.

A number of systems are already on the market, products that can meet current codes and standards, and more importantly are adaptable to retrofits.

The Phantom of the computer strikes again!

Just as we thought we knew how to work our new desktop publishing software (PageMaker on our IBM compatible computer) the computer swallowed some text, so in Solplan Review No. 38 there are a couple of items with statements that contain missing information. To clear up an uncertainty and give credit where it's due:

Advanced Concept Houses: the major sponsors of the first Advanced concept house built in Brampton, Ontario were Energy, Mines and Resources Canada and the Ontario Ministry of Energy.

New Commercial scale HRV: Van EE has a new larger scale HRV (the ECM450) that was designed for use in portable classrooms. The last line in our item got cut off. It stated that this unit may do the job for spaces that have special ventilation needs such as schools, designated smoking rooms or labs.

Advanced Concepts Field Trials Update

Development of EMR's Advanced Concepts Field Trials program is proceeding. Program details are being finalized and staff of EMR CANMET are quietly affirming the department's commitment to the program to various groups in the building industry. An official announcement will not be made until the program details have been finalized and approvals obtained.

Under the Advanced Concepts program, CANMET will assist a limited number of teams to design, build and monitor houses which meet or exceed the energy performance of the Advanced House, built in Brampton, Ontario. Advanced Concepts houses will also be required to meet environmental standards relating to issues such as water consumption and waste management.

The Draft Technical Requirements have been revised as a result of comment received at a meeting in April co sponsored by CHBA's Technical Research Committee (TRC) and EMR (see Solplan Review No. 38). The Requirements now feature a single energy target for all energy uses.

The Selection Criteria have been finalized and a Selection Committee has been struck to review the project proposals. The Committee includes representatives from CHBA, CMHC, Environment Canada, EMR and experts in low energy buildings.

During May and June, CANMET staff made several presentations on the program to key groups in the housing industry. Dr. Everell, the Assistant deputy Minister for EMR's Mineral and Technology Sector, affirmed the department's commitment to the program at meeting of CHBA's Technical Research Committee in Montreal and the Manufacturers' Council in Toronto. Tim Mayo of CANMET's Buildings Group also confirmed the department's plans for the program in a presentation to the National Housing Research Committee.

Official announcement of the Advanced Concepts Field Trials program, including a request for proposals, is expected soon. In the meantime, those interested in more details on the program may obtain copies of the final Selection Criteria and the Technical

Requirements from the provincial or National Home Builder's Association.

Roach Problems?

We came across a small item that underlies another reason why it's worth avoiding moisture in construction. The U.S. Agriculture department's Insect Research Lab in Florida discovered that cockroach infestations can be prevented if a constant breeze can be maintained in attic and wall cavities. They believe that roaches, which must stay moist to survive, avoid the drafts because it dries them out.

Roaches are most commonly found in bathrooms and kitchens, where there is lots of moisture and lots of unsealed holes around plumbing penetrations into the wall structure. If the structure is sealed and kept dry, the environment is less friendly for the critters and voila, no cockroaches!

Autonomous Housing Award

At its June meeting, the Solar Energy Society of Canada (SESCI) approved the establishement of an annual award for built houses that show the best approaches to zero energy consumption and environmental sustainability.

The award will recognize houses that have been occupied year-round for at least one year, and that have documented proof of performance. Details of the terms of reference and judging criteria will be made available as soon as they are finalized. The awards will recognize that many exceptionally good examples have already been built by people who just wish to put the ideas into practice, usually without benefit of government or other agencies.

The first awards should be presented at the SESCI 1992 Annual conference in Edmonton.

SESCI is also looking for contributions to an awards endownment fund, the proceeds of which will be used to adminster the annual awards. To make a contribution, of for more details, contact SOLPLAN REVIEW.

K.D. Lumber

We were under the impression that lumber, once kiln dried, never completely re-saturates itself if it becomes wet. The thinking was that in the process of kiln drying, the fibre cells shrink permanently.

It appears this is wrong. Short term wetting of the lumber does little harm, but if the lumber is allowed to sit in the rain or a puddle for a long time it will resaturate.

The moral? If you are using K.D. lumber, don't get it wet. If you are building during the monsoon season, and are using KD lumber, try to put the structure under the roof as soon as possible if it can't be avoided that there will be some water, then try to drain all areas to avoid standing pools on subfloors.

Housing Innovations

All of a sudden it seems that everybody wants in on the action. EMR and CMHC are launching new innovative housing programs. To avoid the confusion, here's what's going on:

EMR's **Advanced Housing Concepts** house program (as explained in an accompanying story) is a program to provide an opportunity to build and monitor homjes that incorporate innovations in housing technology, many of which will not yet be commercialized, but be at the Research and development stages.

CMHC's **Healthy Housing Design Competition** is a competition for designs that best integrate nergy efficicency and healthy environmental features for housing.

The Solar Energy Society of Canada (SESCI) **Autonomous Housing Award** (details of which are being finalized) is an awards program for houses that have already been built and occupied for at least one year - in other words a recognition of houses that prove energy efficient, environmentaly sustainable features put into practice and that can be shown to work.

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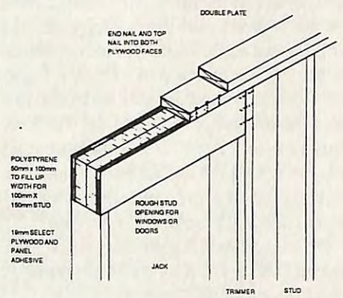
Job-Site Innovator

Canada Mortgage and Housing Corporation is encouraging builders, renovators, and tradespeople to develop and share simple construction techniques that can make construction or renovation easier, faster or more cost-effective. These job-site innovations must be new construction techniques that anyone in the building industry can use without special equipment or products.


DOUBLE PLATE
END NAIL AND TOP NAIL INTO BOTH PLYWOOD FACES
POLYSTYRENE 50mm x 100mm TO FILL UP WIDTH FOR 100mm X 150mm STUD
18mm SELECT PLYWOOD AND PANEL ADHESIVE
ROUGH STUD OPENING FOR WINDOWS OR DOORS
JACK
TRIMMER
STUD

Laminated Lintels: Jobsite Innovation

Conventional window and door lintels are framed with dimension lumber. Spacers and cripples hold the lintels in place and fibreglass insulation is stuffed around the frame. When the wood shrinks, the cripples may float free causing the top plates to sag.

Richard Lind of **Everts-Lind Enterprises** Bridgewater, NS has come up with a way to pre fab headers. It involves Laminating polystyrene insulation between 2 - 3/4" layers of select plywood to the depth of lintel required. Construction panel adhesive joins the layers. Load-bearing walls must have solid blocking at each end.

Laminated lintels will not shrink, so the wall height does not change and the plates do not lose their support. Cripples are not needed and both faces give good nailing surfaces. The polystyrene core insulates better than fibreglass stuffed between conventional lintels.

This innovation may need an engineer's approval in some areas. Confirm municipal approval before using this technique.

A Jig for the Installation of Fascia Boards

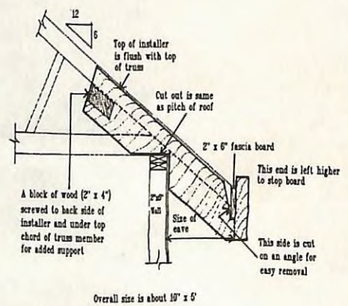
Installation of 2" x 6" fascia boards into the ends of tail rafters can be an awkward operation. It often requires two persons, or the board must be temporarily nailed and then re-nailed.

A re-useable jig that slips easily into place and holds the fascia board ready for final adjustment and nailing has been developed by **William Van Reil** of **Dale Coleman Construction Ltd** from Avonmore, ON.

To make a jig, cut a 5 ft piece of 5/8" or 3/4" plywood to match the pitch of the roof, and the size of the eave, and cut out a slot for the 2x6 fascia. Make an angled cut on the inside of the fascia board slot for easy removal of the jig once the fascia is in place. The top of the jig should be flush with the top of the truss. Rough size of jig is 10"x5'. Two jigs per job site are needed.

A 2"x4" wood block is screwed to the backside of the jig so that top of jig lines up with the top of truss. This block can also be tacked to the top of the truss for added support.

To disengage the jig move the top end over to one side and swing up and out.The jig is easy and cheap to construct, and can be stored for future use if desired. It is cost-effective as it acts as a second set of hands.


12
5
Top of installer is flush with top of truss
Cut out is same as pitch of roof
2" x 6" fascia board
This end is left higher to stop board
A block of wood (2" x 4") screwed to back side of installer and under top chord of truss member for added support
2"x6" tail
Size of eave
This side is cut on an angle for easy removal
Overall size is about 10" x 5'

Technical Research Committee News

Canadian Home Builders' Association

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and developments in the housing sector. Membership includes builder members and representatives from industry, standards and government bodies with an interest in housing. Anyone with a problem, a technical question or suggestion for areas that need looking into is encouraged to contact the local Home Builders' Association technical committee or to the TRC directly.

To contact the TRC:
Canadian Home Builders Association200
Elgin St. Suite 50 Ottawa, Ont., K2P 1L5 Tel:(604) 230-3060

Advanced Concepts Houses

The TRC is actively working with EMR on the development of the Advanced Concepts Field Trails program. This program will encourage and assist the development of new housing technologies that we will be seeing in the future. To participate, or to get more information, contact the TRC.

Residential Fire Sprinklers

While the standing committee on Housing and Small Buildings (Part 9 of the National Building Code) has unanimously rejected the proposal to require fire sprinklers in all one and two family dwellings, there is still a lot of pressure from some fire departments and the sprinkler industry.

To properly deal with the issues of concern, and to pull together all the relevant information on the topic, an information kit has been prepared with the support of CMHC and is now available. This package identifies relevant data on sprinklers, including cost benefits, and other applicable issues that must be considered.

Copies are available from your local CHBA association or contact the TRC directly.

1995 National Building Code

The 1990 changes to the Building Code have not yet been adopted in many part of the country, so it may seem a bit early to talk about the 1995 edition.

Sorry to disappoint you, but it's not too early. Because of the long review process, submissions for changes must be in very soon. One of the significant changes that is expected is (no, not a re-write of the code) but an illustrated Housing Code. This will put Part 9 into a stand alone document. It will be similar in format to the Ontario Housing Code document issued this year.

If you have any concerns about the code language, and would like to see changes, now is the time to make them know. You can write to the Associate Committee on the National Building Code at the National Research Council, Ottawa, Ont. or let your local CHBA Technical Advisory Committee know and they can forward them on. You can also contact the TRC directly and let them know your concerns, and they will forward them on.

R-2000 Ventilation Standard Revised

The TRC Management Committee approved the adoption of CSA Standard F326 (Residential Mechanical Ventilation Systems) as the R-2000 ventilation standard with one change: that sealed combustion appliances will be treated as non-vented appliances for pressure considerations.

The ventilation standard will be officially implemented on September 1, 1991. Regional offices will be given some lead time to become familiar with the changes. What this means is that for R-2000 homes which use combustion appliances (such as pulse combustion furnaces) there is no change in whole house pressure imbalance limit.

Ventilation Task Force

This industry group has been working on a position paper on residential ventilation. It is expected that the paper will be ready in September. It will offer CHBA's perspective on this important issue.

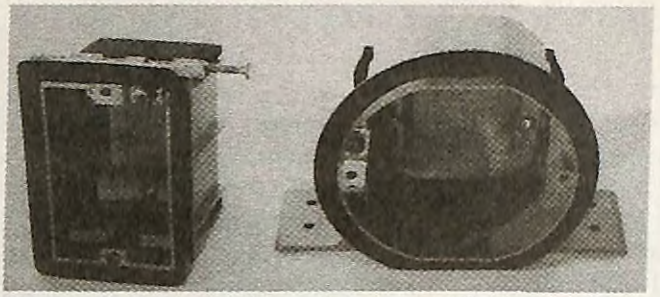
R22 Wall Insulation

Fiberglas Canada recently launched a new higher density R22 Insulation. It provides high thermal performance by being designed to fit the 5½'' cavity of 2x6 exterior walls. This new 5½'' thick product is specially designed to deliver the R22 level specified for Zone 2 in the 1990 Ontario Building Code. It is more energy efficient than other techniques for insulating 2x6 cavities as there is no loss in insulating value due to compression of thick batts.

It is currently available throughout Ontario in sizes for 16" and 24" centre framing. It will soon be available nationally.

R22 is the first of a group of Fiberglas Canada insulation products that will be marketed under the name of Performance Plus, a category for high R value products.

It's so simple; it's brilliant



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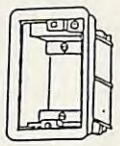

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CMHC's Healthy Housing Design Competition invites you to accept the challenge!

The Research Division of Canada Mortgage and Housing Corporation (CMHC) invites designers to develop *healthy housing* designs, healthy for home occupants, and healthy for our global environment.

Criteria to be addressed include:

- improving indoor air quality;
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- making optimum use of sites and floor space; and
- achieving minimal environmental impact.

For details on the competition or other CMHC environmental initiatives, please write, fax or call:

CMHC, Research Division,
682 Montreal Road
Ottawa, Ontario K1A 0P7

Telephone: 748-2319
Fax: 745-1741

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